

Model **V-850** (MC and SC)
Atom Infant Incubator
Service Manual

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-V17B6-

ATOM MEDICAL CORPORATION

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Introduction

The ATOM Model V-850 INFANT INCUBATOR controls via microprocessor the incubator air temperature to provide an optimum, hitherto unavailable physiological environment for an infant in the incubator. It is equipped with various alarms designed for patient safety. Please make certain that the incubator has been operated properly before coming to the conclusion that the incubator is out of order. In many cases, lack of knowledge of the operating procedures is the cause of mistaking an activated alarm for a malfunction.

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1. Specifications of V-850 Infant Incubator

Electrical requirements: Customer-specified

Skin temperature/incubator temperature control mode: SC/MC system

Skin temperature setting: 34.0-38.0°C in 0.1°C steps

Skin temperature indication: 30.0-42.0°C in 0.1°C steps

Incubator temperature setting: 25.0-38.0°C in 0.1°C steps

Incubator temperature indication: 20.0-42.0°C in 0.1°C steps

Wall temperature/humidity indication: Switch-selected

Wall temperature: 20.0-42.0°C in 0.1°C steps

Humidity: 20-99% in 1% steps

Heater output: 0-Full, indicated in ten degrees

> 37°C indication: Should the incubator temperature exceed 37°C, "> 37°C" indicator will light up and an audible alarm will sound.

Alarms:

Over-temperature alarm

Should the displayed value of the incubator air temperature exceed 39.0°C or should the temperature of the over-temperature sensor exceed $39.5 \pm 0.5^\circ\text{C}$, the over-temperature indicator lamp will flash, an audible alarm will sound, and the heater power will be disconnected.

Internal air circulation alarm

Should any trouble develop within the air circulation system, the appropriate indicator lamp will flash, an audible alarm will sound, and the heater power will be disconnected.

High/low temeprature alarm

(MC mode of operation) Should the incubator air temepra-
ture exceed the pre-selected
temperature by more than 1.5°C or
drop below the set temeprature by
more than 3°C , the selected tem-
perature indicator lamp will flash
and an audible alarm will sound.

(SC mode of operation) Should the infant's skin tempera-
ture deviate from the pre-selected
temeprature by more than $\pm 1^{\circ}\text{C}$, the
selected temperature indicator lamp
will flash and an audible alarm
will sound.

Internal sensor alarm

Should any trouble develop on any of the sensors for incu-
bator air temperature, wall temperature, humidity, over-
temperature and internal air circulation, the internal
sensor indicator lamp will flash and an audible alarm will
sound.

Skin temeprature probe alarm

Should any trouble develop on the skin temperature probe,
the skin temperature probe indicator lamp will flash, an
audible alarm will sound and the heater power will be
disconnected.

Power failure alarm

Should power supply be interrupted due to power failure or other causes, the power failure indicator lamp will be illuminated and an audible alarm will sound.

2. Composition of V-850 Infant Incubator (temperature control)

V-850 Infant Incubator is composed of six sensors to monitor several temperatures, humidity and air flow respectively, a heater to warm up the incubator air, a fan for internal air circulation and six P.C. boards for controlling and displaying such features or parameters.

2.1 Functions of sensors

Incubator air temperature sensor

Detects the air temperature in the incubator.

Relative humidity sensor

Detects the temperature affected by evaporation heat. The sensor is covered with a wet nonwoven fabric.

Wall temperature sensor

Detects the wall temperature affected by radiation.

Over-temperature sensor

Detects an excessive rise in the incubator air temperature using an independent circuit.

Air flow sensor

Detects changes in the internal air circulation.

Skin temperature sensor

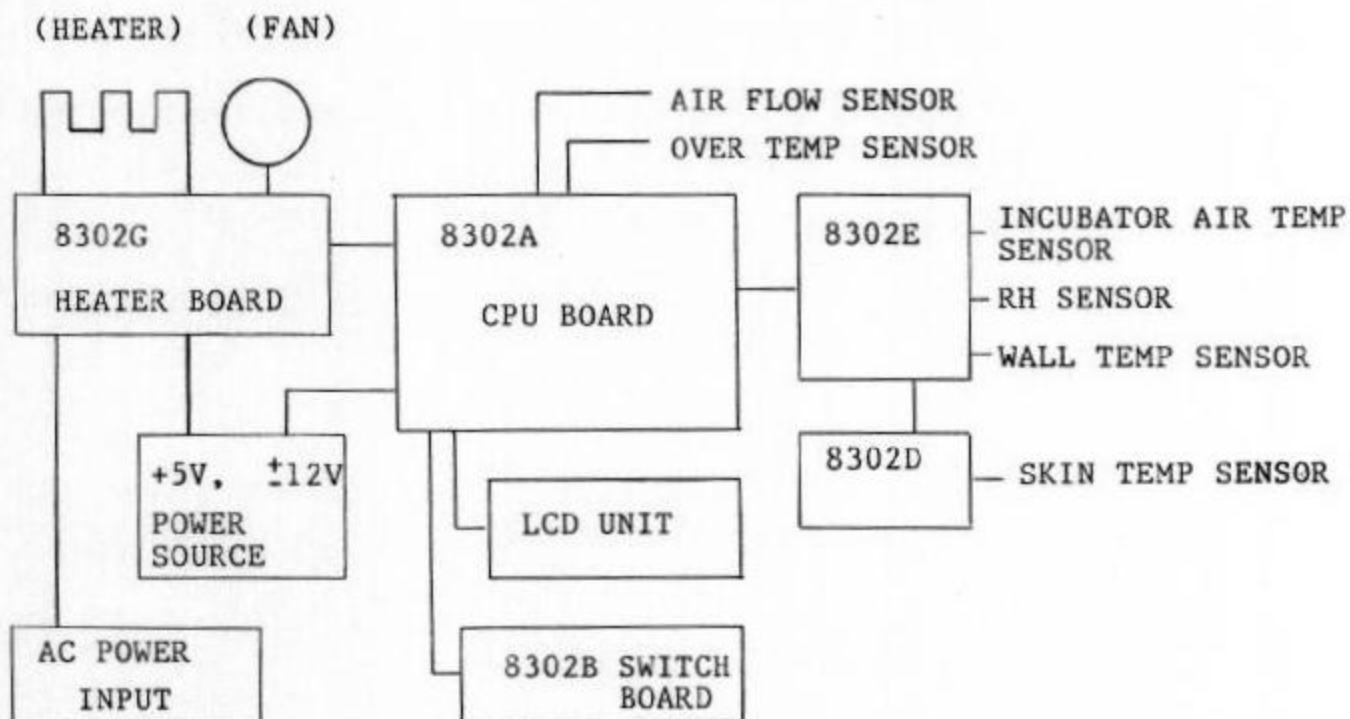
Detects the infant's skin temperature. The sensor is attached to the infant's skin.

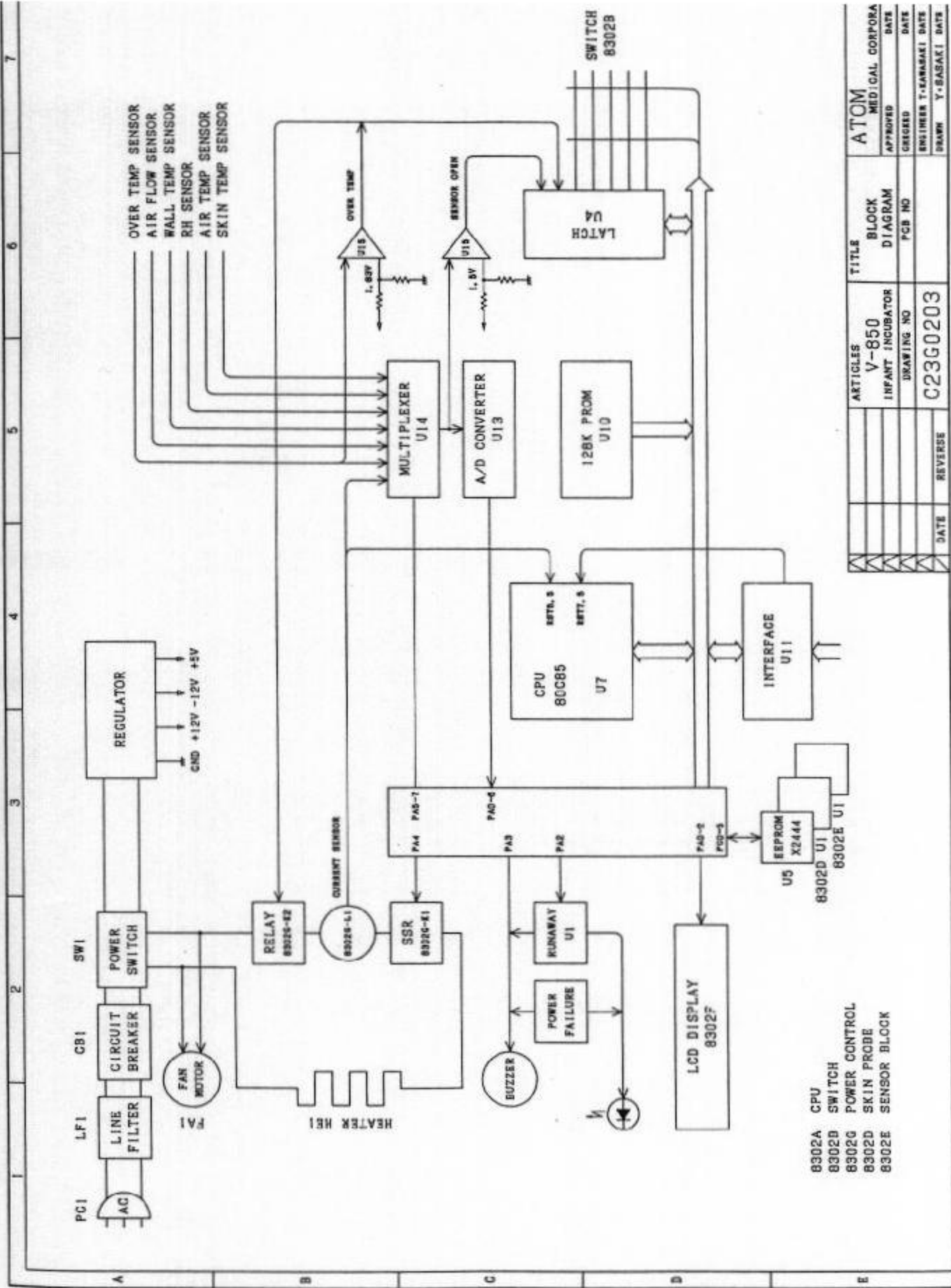
2.2 Primary functions of boards

- 8302A The main board equipped with CPU, in charge of all controls.
- 8302B The switch board equipped both with switches for operation and with power failure alarm LED.
- 8302G Equipped with a heater power control relay and a current-detecting coil.
- 8302D Equipped with EEPROM in which data from a skin temperature thermistor are stored.
- 8302E Equipped both with thermistors for incubator air temperature, RH and wall temperature and with EEPROM in which sensor calibration values are stored.

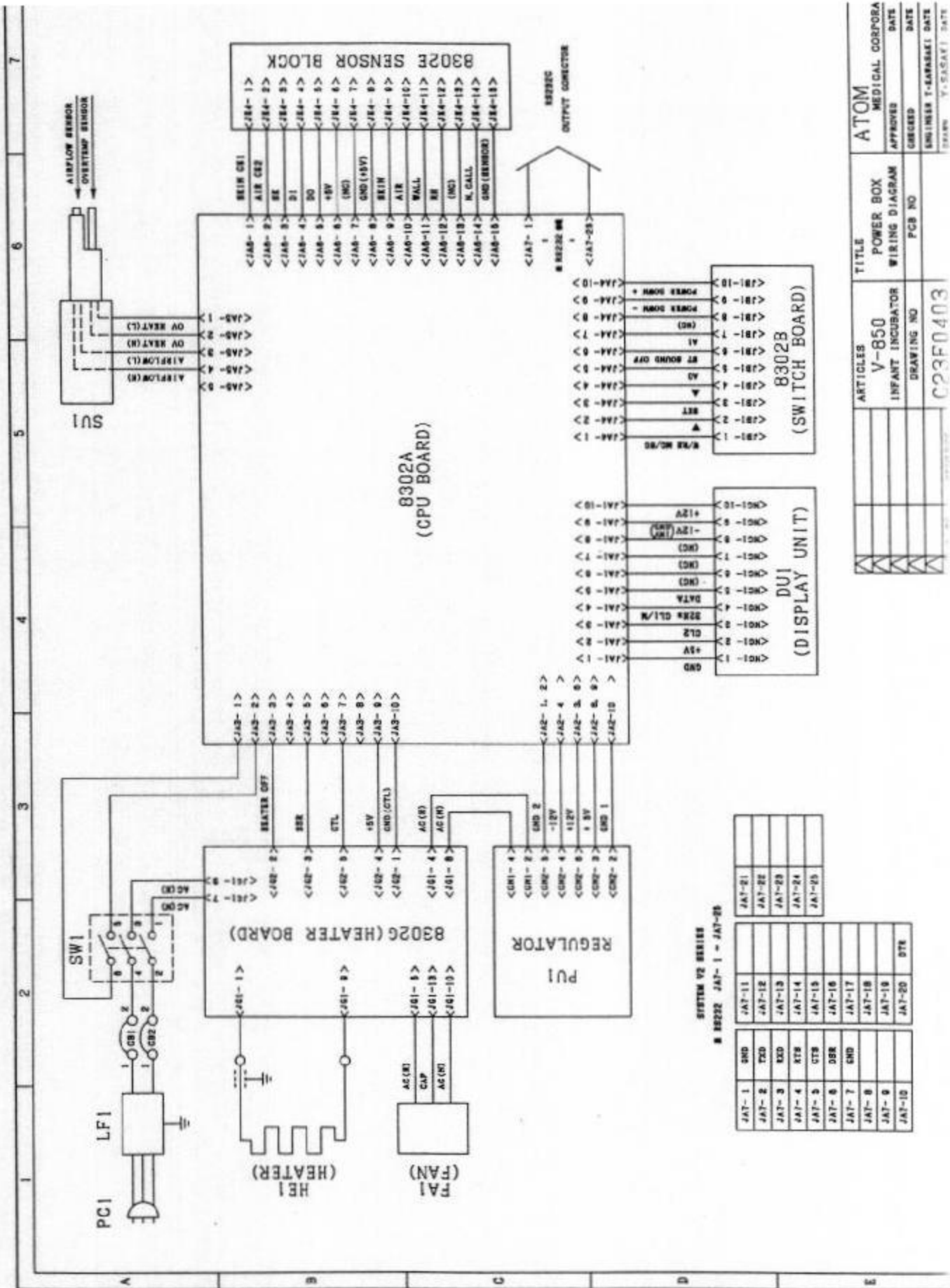
2.3 Others

Power source	+5V (3A), +12V (1.2A), -12V (0.3A)
Heater	260VA
Fan motor	Makes the air circulate in V-850 Infant Incubator
LCD unit	Displays various control data and conditions of V-850 Infant Incubator





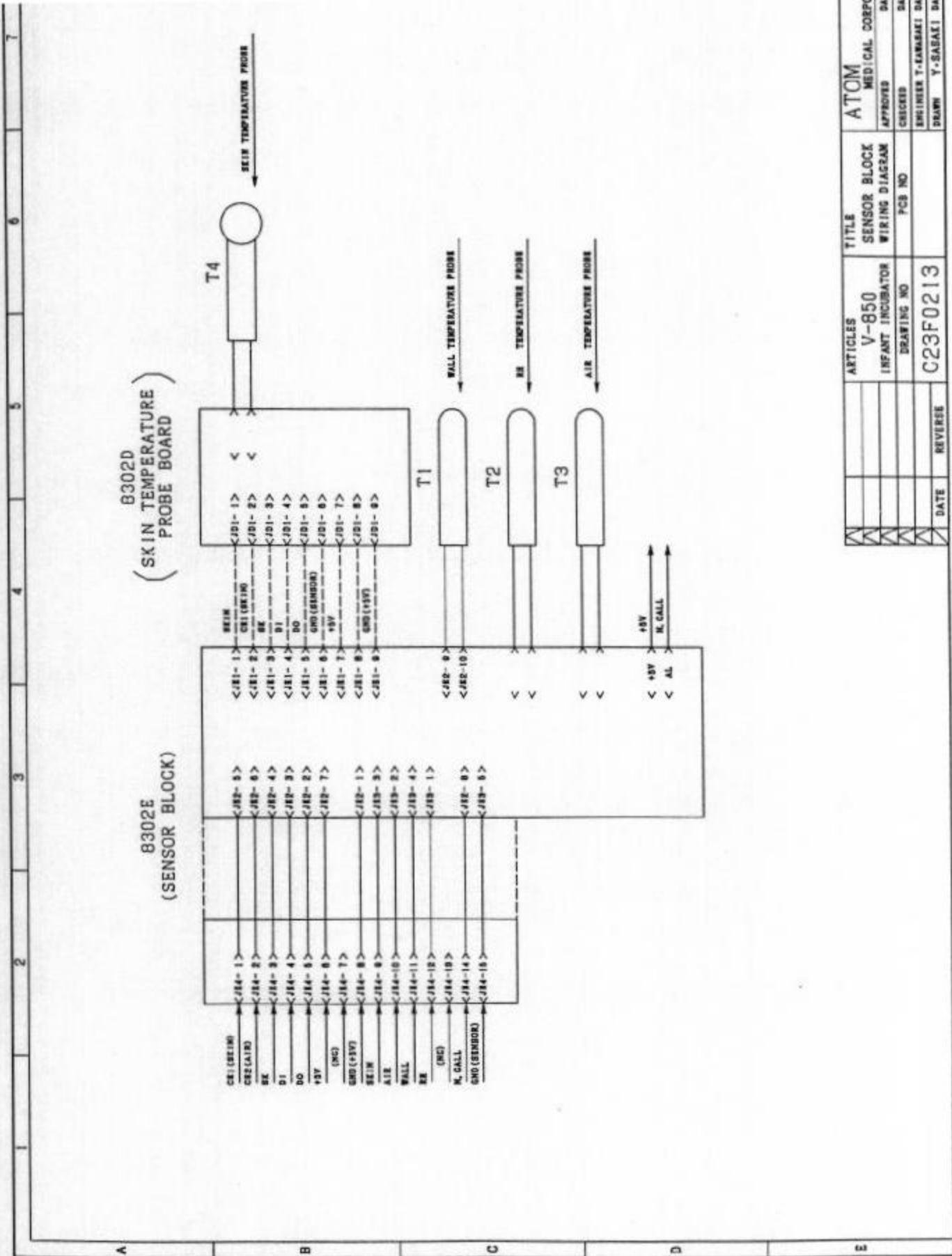
ARTICLES		TITLE		BLOCK		ATOM	
V-850		INFANT INCUBATOR		DIAGRAM		MEDICAL CORPORA	
DRAWING NO		PCB NO		DATE		DATE	
C23G0203							
DATE		REVERSE		ENGINEER T. KAWASAKI		DATE	
				DRAWN Y. SASAKI		DATE	

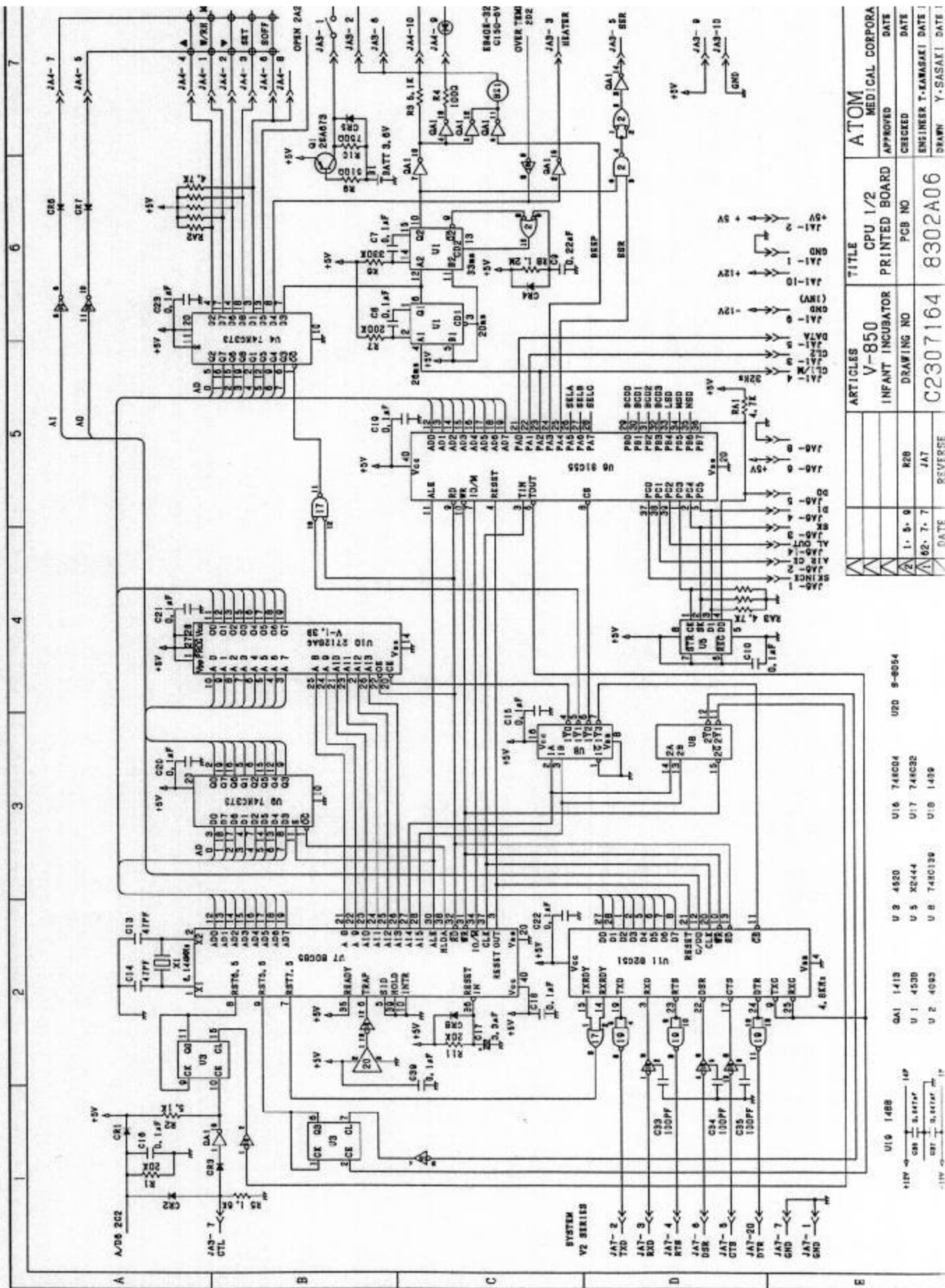


SYSTEM V2 SERIES
83222 JAT-1 - JAT-25

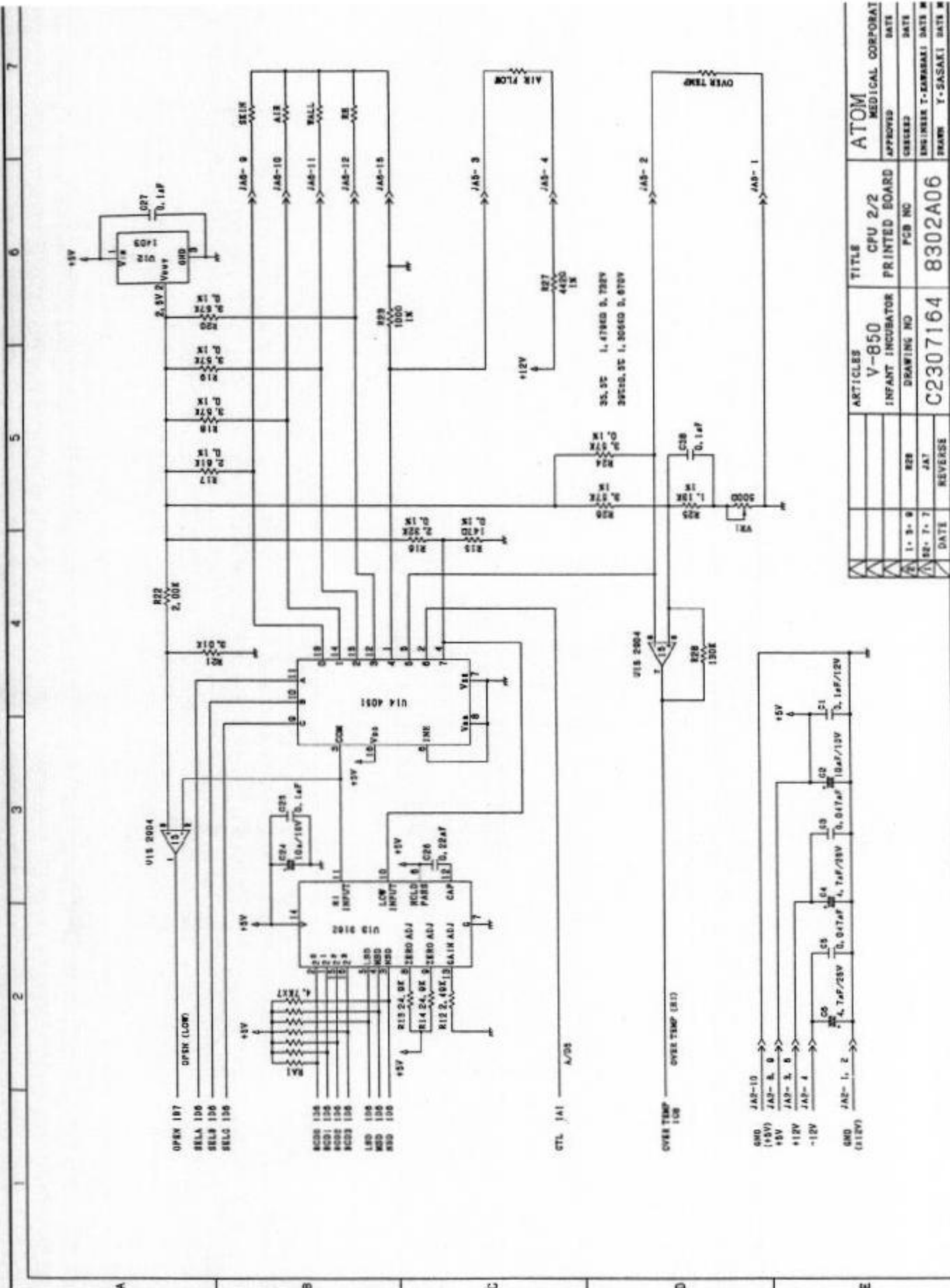
JAT-1	END	JAT-11		JAT-21	
JAT-2	TXD	JAT-12		JAT-22	
JAT-3	RXD	JAT-13		JAT-23	
JAT-4	RTS	JAT-14		JAT-24	
JAT-5	CTS	JAT-15		JAT-25	
JAT-6	DSR	JAT-16			
JAT-7	END	JAT-17			
JAT-8		JAT-18			
JAT-9		JAT-19			
JAT-10		JAT-20	DTX		

ARTICLES		TITLE	
V-850		POWER BOX	
INFANT INCUBATOR		WIRING DIAGRAM	
DRAWING NO		PCB NO	
C23F0403			
DATE		DATE	
ENGINEER T. KAWABATA		DATE	
CHECKED		DATE	
APPROVED		DATE	
ATOM		MEDICAL CORPORA	





ARTICLES		TITLE		ATOM	
V-850		CPU 1/2		MEDICAL CORPORA	
INFANT INCUBATOR		PRINTED BOARD		APPROVED DATE	
R28	DRAWING NO	PCB NO	CHECKED	DATE	
62. 7. 7	JAT	8302A06	ENGINEER T. KAWASAKI	DATE	
DATE	REVERSE		DRAWN Y. SASAKI	DATE	



ARTICLES		TITLE		ATOM	
V-850		CPU 2/2		MEDICAL CORPORAT	
INFANT INCUBATOR		PRINTED BOARD		APPROVED	
DRAWING NO		PCB NO		DATE	
C2307164		8302A06		ENGINEER T-KAWASAKI	
DATE		REVERSE		DATE	
1. 3. 9		R28		DATE	
2. 7. 7		JAT		DATE	
				DRAWN Y-SASAKI	

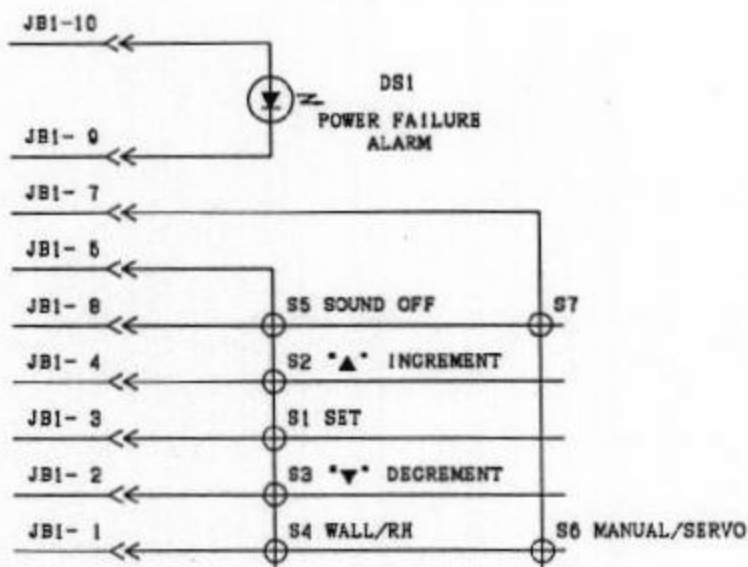
A

B

C

D

E



MC unit is not
equipped with S6

△		ARTICLES	TITLE	ATOM
△		V-850	SWITCH	MEDICAL CORPORATIO
△		INFANT INCUBATOR	PRINTED BOARD	APPROVED DATE
△		DRAWING NO	PCB NO	CHECKED DATE
△		C2307234	8302B03	ENGINEER T.KAWASAKI DATE MAR
△	DATE	REVERSE		DRAWN Y.SASAKI DATE MAY

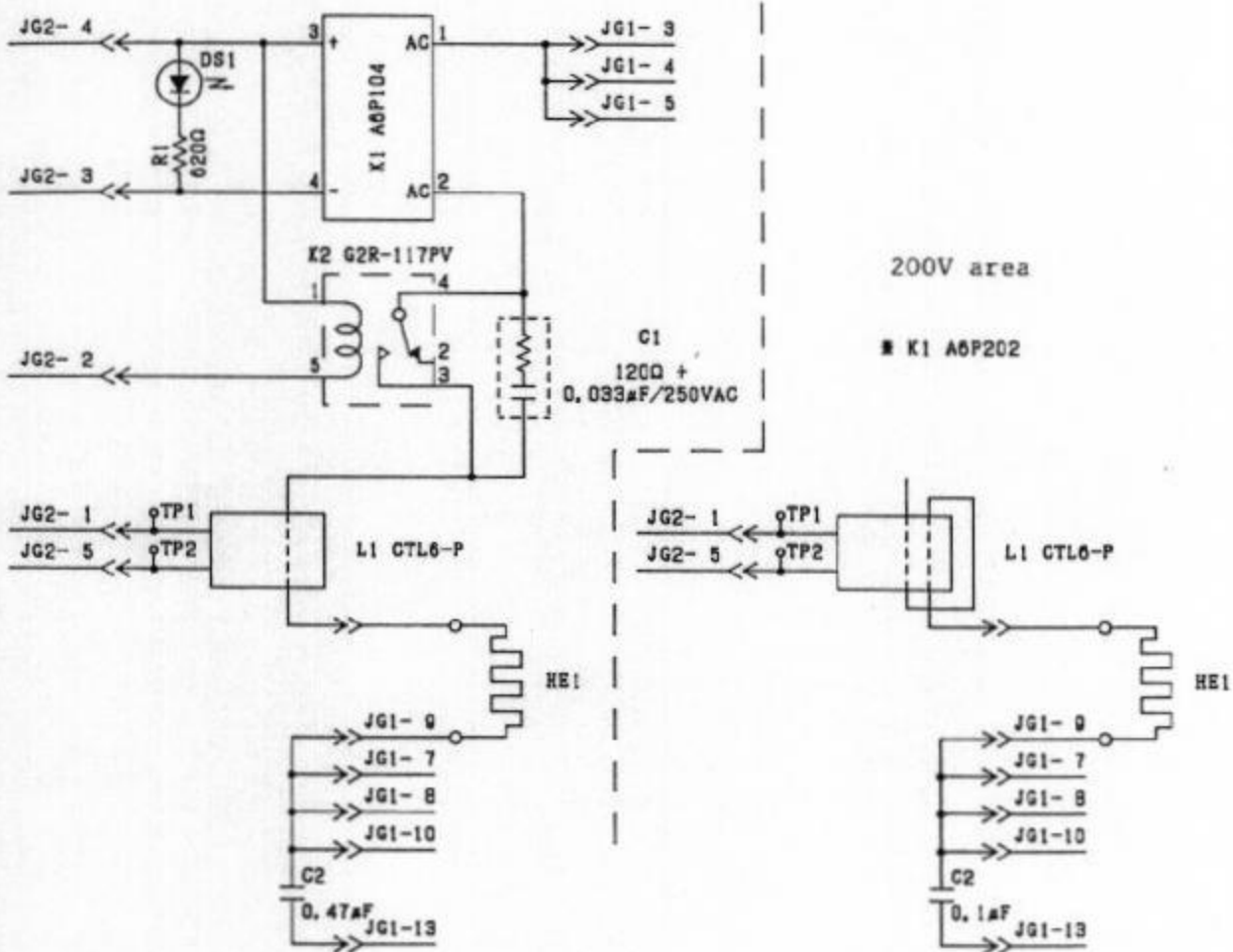
A

B

C

D

E



ARTICLES	V-850	TITLE	HEATER	ATOM
INFANT INCUBATOR	DRAWING NO	PCB NO	8302G00	MEDICAL CORPORATION
DATE	REVERSE	C2307404	8302G00	APPROVED
				DATE
				CHECKED
				DATE
				ENGINEER T. KAWASAKI
				DATE SEP '87
				DRAWN Y. SASAKI
				DATE SEP '87

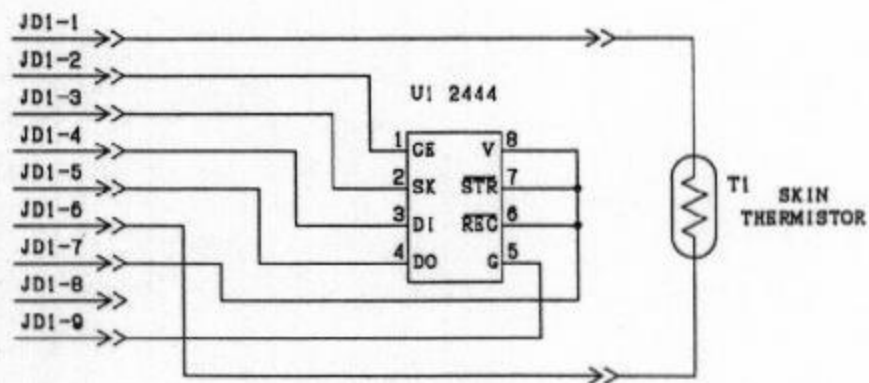
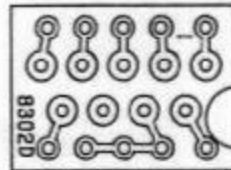
A

B

C

D

E



		ARTICLES	TITLE	ATOM	
		V-850	SKIN PROBE	MEDICAL CORPORATION	
		INFANT INCUBATOR	PRINTED BOARD	APPROVED	DATE
		DRAWING NO	PCB NO	CHECKED	DATE
		C2308204	8302D00	ENGINEER T. KAWASAKI	DATE MAR '87
DATE	REVERSE			DRAWN Y. SASAKI	DATE MAY '87

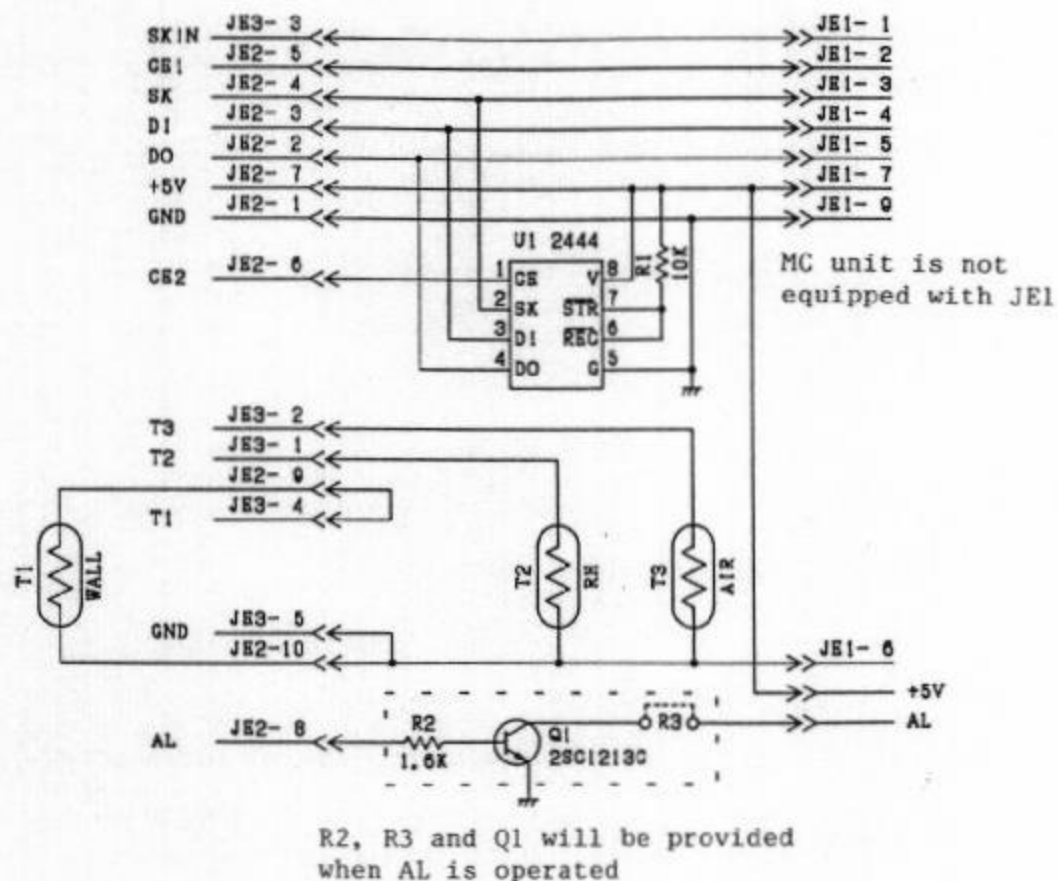
A

B

C

D

E



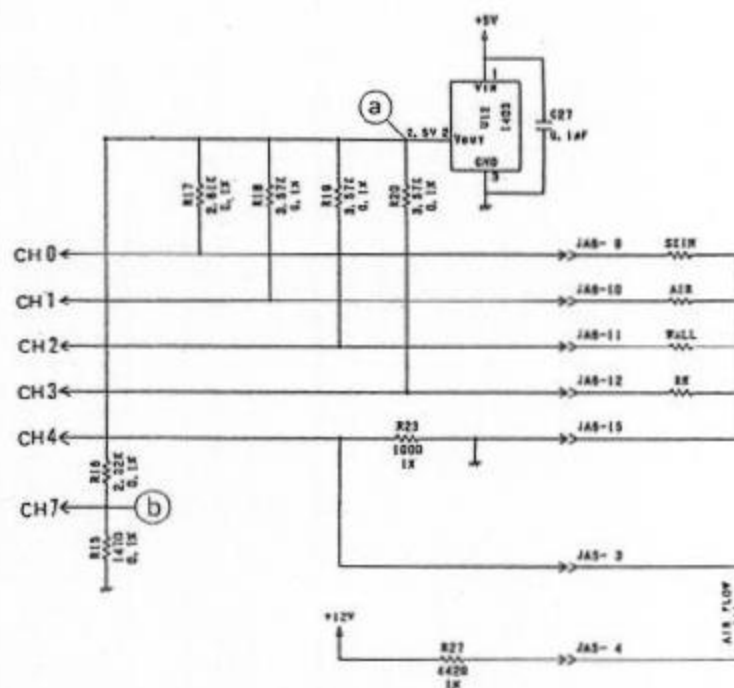
		ARTICLES	TITLE	ATOM	
		V-850	SENSOR BLOCK	MEDICAL CORPORATION	
		INFANT INCUBATOR	PRINTED BOARD	APPROVED	DATE
		DRAWING NO	PCB NO	CHECKED	DATE
	DATE	REVERSE	C2307624	8302E02	ENGINEER T. KAWASAKI DATE MAR '87
					DRAWN Y. SASAKI DATE MAY '87

6. Description of Circuitry

6-1 Reference voltage input

As the unit must measure temperature very accurately, $2.5V \pm 25mV$ is supplied by an IC (U12, pin2) designed to generate highly precise reference voltage.

Output, in proportion to changes in temperature detected by each sensor, is generated at CH0-4.



(Test Point) * a ... $2.5V \pm 25mV$

* b ... $0.15V \pm 5mV$

* If virtual resistance ($1K \sim 2k\Omega$) is inserted in the sensor section, specified voltage divided by $R17 \sim 20$ or $R23$ and $R27$ is fed to CH0 - 4.

6-2 Over-temperature detection circuit

An over-temperature condition is detected by the following two methods:

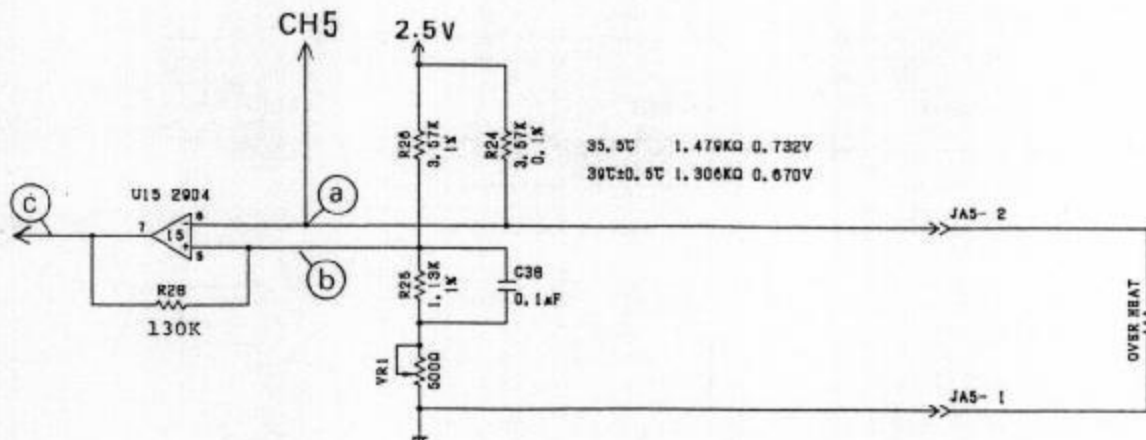
1. When the sensor detects the incubator air temperature at or over $39.0^{\circ}C$, the incubator air temperature sensor judges that an over-temperature condition exists and activates the over-temperature alarm.

2. The over-temperature detection sensor, which is independent of the CPU-controlled temperature measurement circuit, activates the over-temperature alarm when the sensor detects an alarm condition at $39.5 \pm 0.5^\circ\text{C}$. In this case, both the audible and visual alarms will be automatically reset when the air temperature is felt by the sensor to have fallen by $2\text{-}3^\circ\text{C}$ from the alarm temperature level.

The temperature information obtained by the over-temperature sensor is sent as voltage information to CPU via CH5.

When the over-temperature detection sensor becomes activated, the relay (K2) on the 8302C board will go OFF and the heater output will be interrupted.

Ref.) The over-temperature detection level is adjusted with VR1. Refer to 11. Over-Temperature Adjustment for procedures.



(Test Point) * a ... If virtual resistance ($1\text{k} \sim 2\text{k}\Omega$) is inserted in the sensor section, specified voltage divided by R25, R26 and VR1 is fed to CH5.

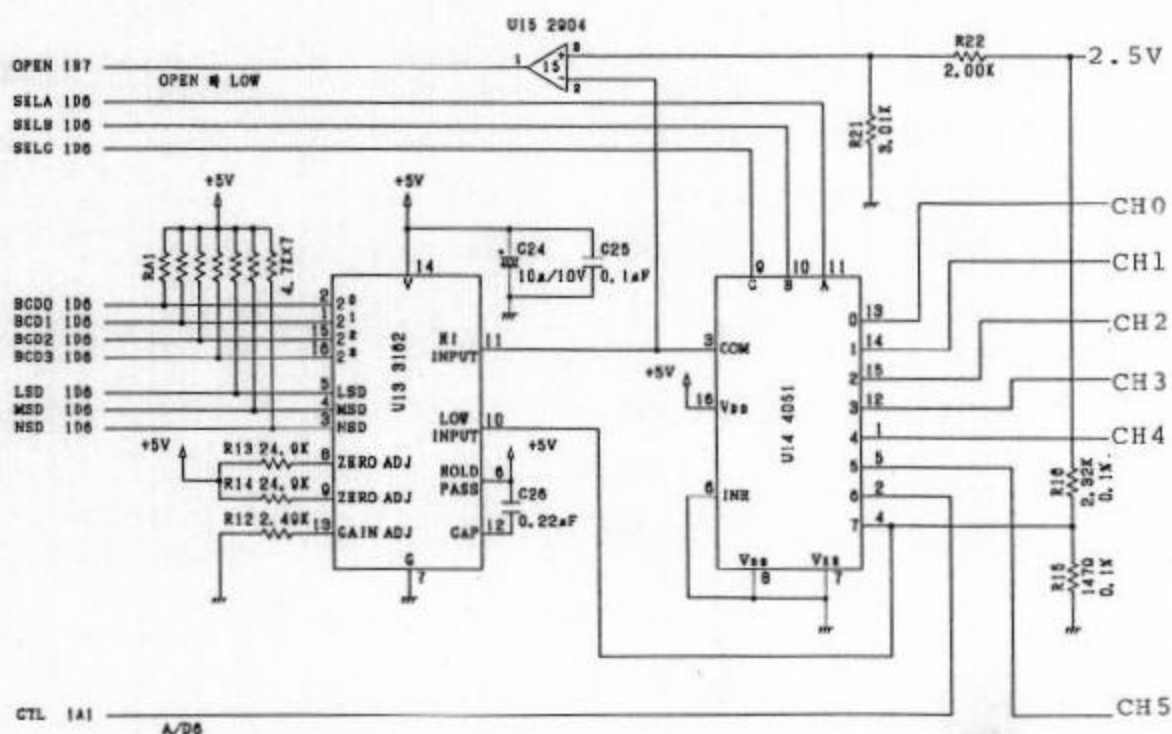
* b ... 0.6 - 0.78V

* c ... Goes high (+5V) in over-temperature conditions (Point a < Point b).

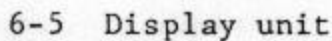
6-3 A/D converter circuit

Temperature data inputted by each temperature sensor are switched over by 8CH multiplexer (U14) and digitally inputted to CPU via 10 bit A/D converter (U13).

The analogue voltage inputted by a sensor will vary within the range of 0.15 - 1.15V in normal conditions. Should the sensor be disconnected, 2.5V will be inputted, or should it be shorted, 0V will be inputted. (In the case of CH4, 0V for disconnection and 2.5V for short.) U15 will output 0V in case of sensor disconnection, while CPU will recognize a shorted sensor and give an alarm.



When a key switch incorporated in 8302B board is pressed, 8 bit latch (U4) will input the key information to CPU via AD 0 - 7.



6-6 Power failure detection / battery charge circuit

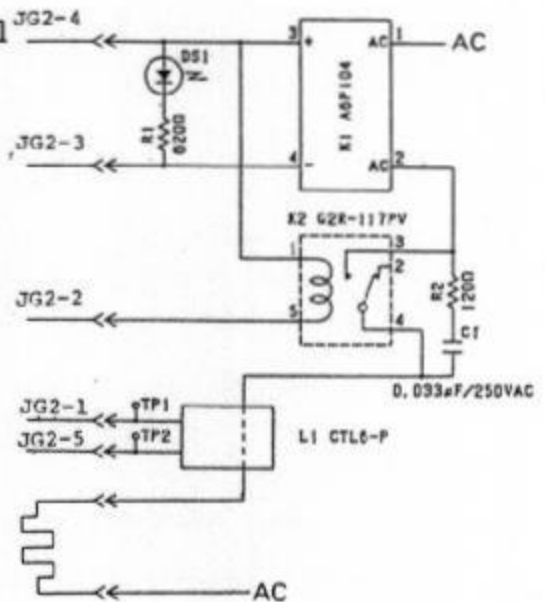
supplied even though the power switch is depressed.

6-7 Heater output / heater current detection circuit

CPU outputs heater output control

signals via U6 (81C55) port to control K1 (SSR) on 8302G board.

The same output is fed back to CPU by the current sensor (L1) to monitor a trouble developed on SSR, the heater, etc.

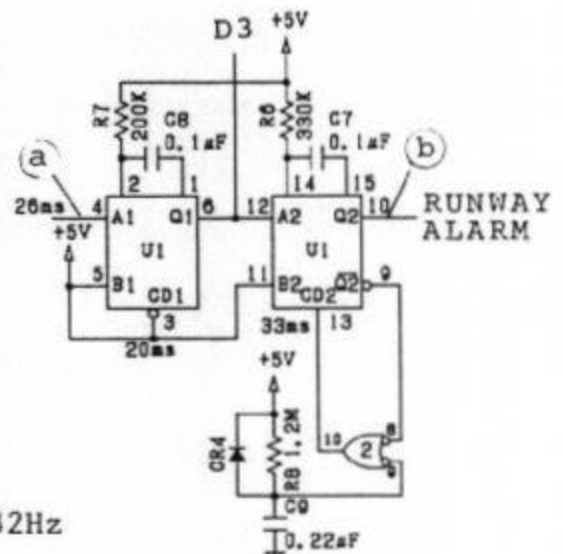


6-8 CPU runaway detection circuit

Should any trouble develop on CPU and the program be in runaway conditions, an alarm will be immediately given, and the heater power will be disconnected.

(Test Point)

- * a ... During normal operation 32Hz
- * b ... During normal operation +5V
- During trouble 0V



6-9 Data backup with EEPROM

When the unit is turned off, function setting backup and correction values for respective sensors will be retained.

Note) As data stored in each EEPROM on 8302A board (CPU board), 8302D board (Sensor unit board) or 8302E board (Skin temperature probe board) correspond to each instrument or sensor, sensors or EEPROM cannot be replaced.

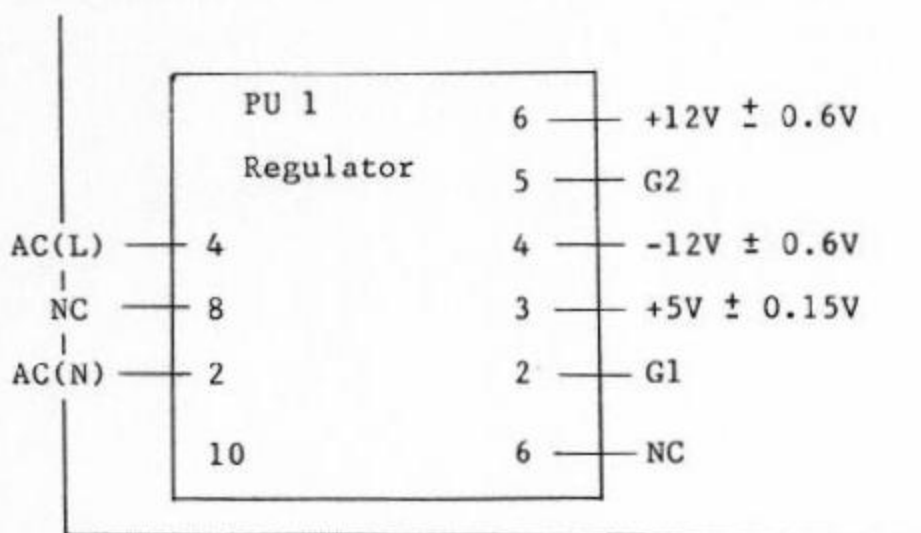
6-10 DC +5V, $\pm 12V$ regulator

The unit is provided with DC +5V, $\pm 12V$ by PU1.

DC +5V is used for most circuitry. Should any trouble develop on this voltage, all operation of the unit will be affected.

DC $\pm 12V$ is used for LCD display backlight. Should any trouble develop on this voltage, LCD display will be darkened.

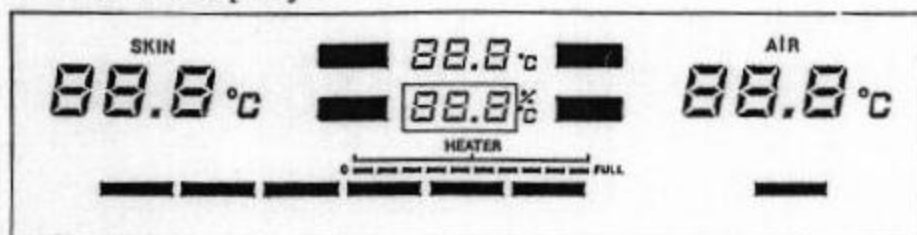
(Test Point)



7. Function Test 2 (Internal Test with Display)

7-1 Display test

When the unit is turned on, it goes through a self-diagnostic LCD test on the display.



(Test Point)

* Neither backlight nor LCD display is on.

.....> Check AC power switch, DC±12V, +5V, and the connector.

Faulty LCD unit

* Backlight is not illuminated.

.....> Check DC ±12V.

Faulty LCD unit.

* LCD segment is missing.

.....> Faulty LCD unit.

* LCD display is not normal, and a power failure alarm is given.

.....> CPU runaway. If the situation is not corrected even when the unit is started again, total malfunction is suspected.

7-2 Sensor test

Sensors are checked for malfunction while the unit is in operation.

(Test Point)

- * A sensor alarm occurs and LCD displays (temperature) are all blank.

-> Defective sensor unit.
Defective cable.
Connector off.

- * A sensor alarm occurs, and incubator air temperature, RH and wall temperature displays go LO or HI.

-> LO means sensor input line disconnection;
HI means short circuit.

- * A sensor alarm occurs, but temperature displays are normal.

-> Either the over-temperature sensor or the air flow sensor is disconnected or shorted.

- * In SC mode, a probe alarm occurs and temperature displays are all blank.

-> Connector is off.
Defective probe.

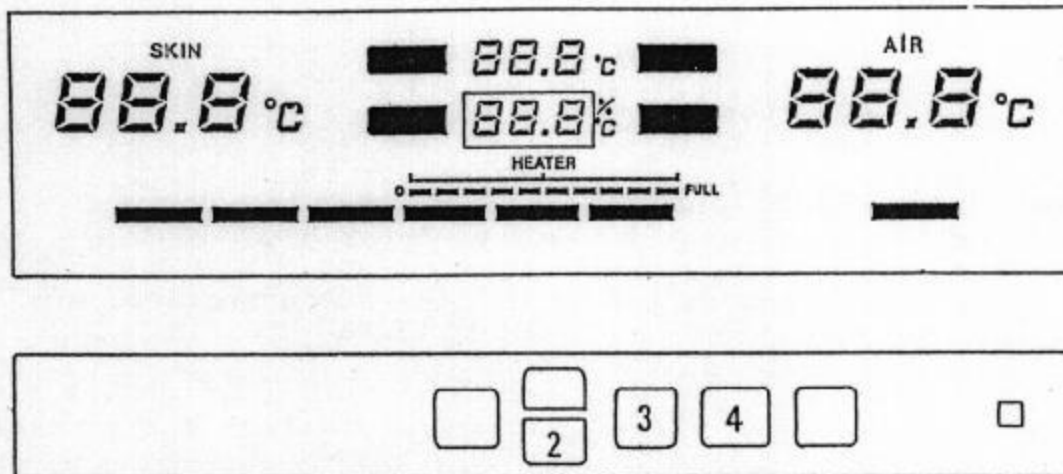
- * In SC mode, a probe alarm occurs and temperature displays indicate either LO or HI.

-> LO means short;
HI means disconnection.

8. Function Test 3 (Special Internal Test via Keyboard)

Special operation of the keyboard permits monitoring and checking the function of A/D converter and the condition of internal air circulation in the V-850 Infant Incubator.

Good care must be taken. An accidental misoperation may destroy the ability of the incubator to function.



8-1 Test mode 1 (A/D converter, internal air circulation, others)

* Setting

Turn the power switch on while depressing Panel Switch 2 (↓). Hold Switch 2 until the self-diagnosis program is completed. Test Mode 1 is selected when CH.0 is indicated on the RH/wall temperature display.

* Operation

Once Test Mode 1 is selected, depress Panel Switch 4 (alarm reset switch), and the RH/wall temperature display will go through a sequence of CH.0→CH.1→CH.2→CH.3→CH.4→CH.5→CH.6

→CH.7→OP→FA→SE→So→H7→V1→V2→Pd→CH.0→ ...

CH.0—DH7 indicate the contents of A/D converter, OP indicates the operating temperature, Fa indicates the flow of air, SE indicates a defective sensor, So indicates a disconnected sensor, H7 indicates the temperature of the RH sensor, V1 and V2 each indicates a program version, and Pd indicates the date of programming.

Depress Panel Switch 3 (RH/wall temperature), and appropriate data will appear on the RH/wall temperature display for CH0-7, OP, FA, SE, So, H7, V1, V2 and Pd.

(Refer to the following description for details of data.)

Note: The V1.3 program does not permit displaying in any of the modes OP Pd.

* To stop the test procedure:

Turn the power switch off and then on.

** ANALYSIS OF DATA IN TEST MODE				
1. Turn the power switch on. Turn Switch 2 (↓) on. LCD Test.			↓	Rh/wall temperature display CH.0
2. Set Test Mode 1.				
SW4	Display 1	SW3	Display 2	
ON↓	CH.0	ON → ←	590	* Status of skin temperature probe 999 ... Probe disconnected -99 ... Probe shorted

ON↓	CH.1	ON → ←	580	* Status of incubator air temperature sensor 999 ... Probe disconnected -99 ... Probe shorted
ON↓	CH.2	ON → ←	580	* Status of wall temperature sensor 999 ... Probe disconnected -99 ... Probe shorted
ON↓	CH.3	ON → ←	580	* Status of RH sensor 999 ... Probe disconnected -99 ... Probe shorted
ON↓	CH.4	ON → ←	645	* Status of air flow sensor -99 ... Probe disconnected 999 ... Probe shorted
ON↓	CH.5	ON → ←	630	* Status of over-temperature sensor 999 ... Probe disconnected -99 ... Probe shorted
ON↓	CH.6	ON → ←	120	* Status of current sensor -99 ... Heater output is zero.
ON↓	CH.7	ON → ←	0	* A/D converter ground 0±1 : normal others: defective interface
ON↓	OP	ON → ←	32.2	* Operating temperature (SC mode) Ref.) Refer to Section 13 for operating temperature.
ON↓	FA	ON → ←	-40	* Status of internal air circulation -40±10 (stabilized): normal over zero: alarm conditions Ref.) Alarm conditions will occur frequently if internal air circulation is not initially set to be normal. Refer to Section 11 for performing initial setting of internal air circulation.

ON ↓	SE	ON → ←	150	* Indicates a defective sensor. 1 ... defective BIT 7 6 5 4 3 2 1 0 — incubator air temperature over-temperature air flow RH wall temperature sensor unit off skin temperature skin temperature probe off
ON ↓	So	ON → ←	198	* Sensor disconnected 1 ... Disconnected BIT 7 6 5 4 3 2 1 0 — incubator air temperature over-temperature air flow RH wall temperature sensor unit off skin temperature skin temperature probe off
ON ↓	H7	ON → ←	365	* Temperature sensed by RH sensor (x10)
ON ↓	U1	ON → ←	013	* Program version 1 017...V17B6 (1989/6)
ON ↓	U2	ON → ←	001	* Program version 2 005...V17B6 (1989/6)
ON ↓	Pd	ON → ←	704	* Date of programming

Note) The V1.3B program does not permit displaying in any of the modes OP~Pd.

Ref.) * The A/D converter values displayed in CH.0-3 are those of the test simulator (36.0°C) ± 15 . The test simulator should be calibrated correctly.)

* The values displayed in CH4 and CH5 are obtained in stabilized conditions with the incubator air temperature at $34.0 \pm 2^{\circ}\text{C}$.

* A defective or disconnected sensor is indicated decimally. Conditions of each sensor are known by converting the decimal system into the binary system.

Ex) SE (defective sensor) Displayed value D = 150 ...
binary system (10010110)

Content ... Skin temp probe off; wall temp
sensor, air flow sensor, over-temp
sensor defective.

Ex) So (disconnected sensor) Displayed value D = 198 ...
binary system (11000110)

Content ... Skin temp probe off; skin temp
sensor, air flow sensor, over-temp
sensor disconnected.

Judging from the displayed values of Se and So, the skin temp sensor must be disconnected due to the skin temp probe off. (In case of MC nothing is wrong as no skin temp sensor is attached.)

A defective wall temperature sensor must mean that the sensor input line is shorted as the sensor is not disconnected.

A defective air flow sensor and a defective over-temperature sensor both mean that the sensors are disconnected, probably their connectors on the same line are off.

Example of calculation

$150 - 2 = 75 \dots \underline{0}$, $75 - 2 = 37 \dots \underline{1}$, $37 - 2 = 18 \dots \underline{1}$,
 $18 - 2 = 9 \dots \underline{0}$, $9 - 2 = 4 \dots \underline{1}$, $4 - 2 = 2 \dots \underline{0}$,
 $1 - 2 = 0 \dots \underline{1}$

Put the underlined figures together one after another beginning with the rightmost position, and you'll get 10010110.

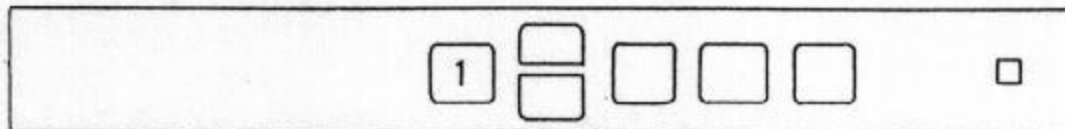
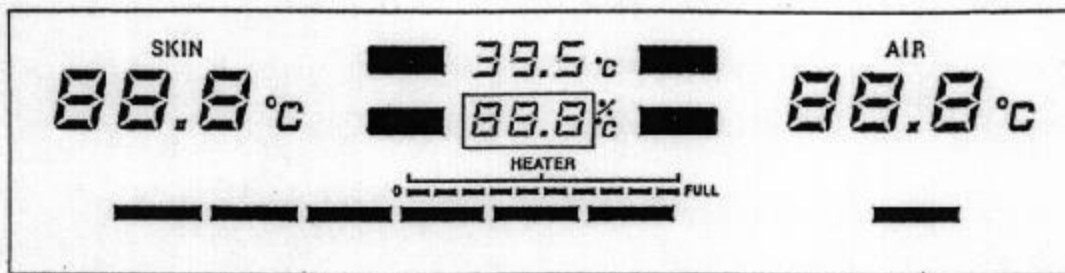
8-2 Test Mode 2 (over-temperature test)

In this test mode, the incubator air temperature can be set to 39.5°C with MC.

* Setting

Turn the power switch on while depressing Panel Switch 1 (setting). Hold Switch 1 until the self-diagnosis program is completed.

Test Mode 2 (over-temperature test) is selected when the incubator air temperature setting reads 39.5°C.



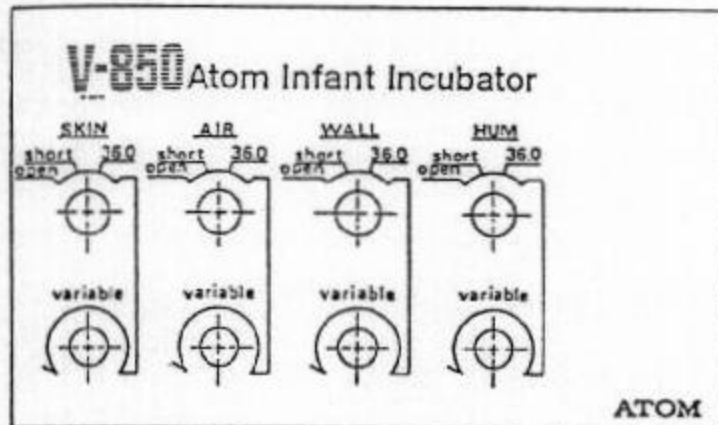
(Test Point)

- * Verify that an over-temperature alarm is given when the incubator air temperature reaches $39.5 \pm 0.5^{\circ}\text{C}$.

Ref.) Refer to Section 11 for adjustment.

9. Function Test 4 (Test with Simulator)

Perform simulation of the control unit with V-850 test simulator.



9-1 Sensor open test

Set the rotary switch of each sensor to "open" to simulate the situation where the sensor is disconnected.

- (Test Point) *
- The heater stops.
 - The value indicated by each sensor (L0) flashes.
 - AD converter indicates 999 in Test Mode 1.

9-2 Sensor short test

Set the rotary switch of each sensor to "short" to simulate the situation where the sensor is shorted.

- (Test Point) *
- The heater stops.
 - The value indicated by each sensor (H1) flashes.
 - AD converter indicates -99 in Test Mode 1.

9-3 36.0°C Test

Set the rotary switch of each sensor to "36.0°C" to verify that the sensor indicates $36.0^{\circ}\text{C} \pm 0.2^{\circ}\text{C}$.

Note) Test Box 1 should be calibrated correctly.

(Test Point) * 36.0 ± 0.2

* AD converter indicates 580 ± 15 in Test Mode 1.

9-4 Simulation test

Set the rotary switch of each sensor to simulated sensor drive to verify the operation of the control unit.

10. Initialization of Internal Air Circulation

Note) The V1.3B program does not permit "Initialization of Internal Air Circulation."

To detect any abnormalities in the internal air circulation, the conditions of internal air circulation stabilized at the reference ambient temperatures (30°C, 34°C, 37°C) are stored in the control unit. Should the fan motor stop or should any abnormality develop at the air outlet or inlet of the internal air circulation system, and internal circulation be disturbed, an alarm will occur.

Improper initialization of internal air circulation may cause abnormalities in the internal air circulation not to be detected properly.

° In such a case, it is necessary to re-initialize.

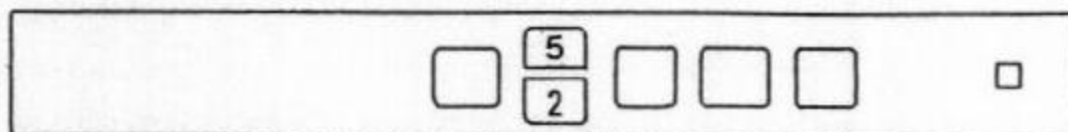
(Test Point) * Check that the unit is set properly. If the value shown of internal air circulation in Test Mode 1 is within the range of -30 to -50, the unit is set properly. However, if it is -10 or above, it is necessary to re-initialize.

10-1 Initialization Technique

Special operation of the keyboard enables you to perform initial setting of the internal air circulation system.

Utmost care should be taken as this intentional misoperation

might destroy internal functioning of the incubator.



* Preparation of setting 1.

... Set the unit (access port, mattress platform, humidity reservoir, etc) securely. Fill the humidity reservoir with water to a specified level and set the adjusting lever to high humidification.

Note) The unit, once set, cannot be reset until the initial setting of the internal circulation system is completed. Should any procedure be done on the unit in the meantime, initial setting may not be performed properly.

* Preparation of setting 2

... Turn the power switch on while depressing Panel Switch 2 (↓) and 5 (↑) simultaneously. Hold Switch 2 and 5 until the self-diagnosis program is completed.

Initial setting of internal circulation is started when the RH/wall temperature display reads FAN.

* During initial setting

... The incubator air temperature changes automatically from 30 through 34 to 37°C. Stabilized conditions of internal circulation at each temperature range are memorized.

* Setting completed

... Initial setting of internal circulation is completed when the RH/wall temperature display reads END.

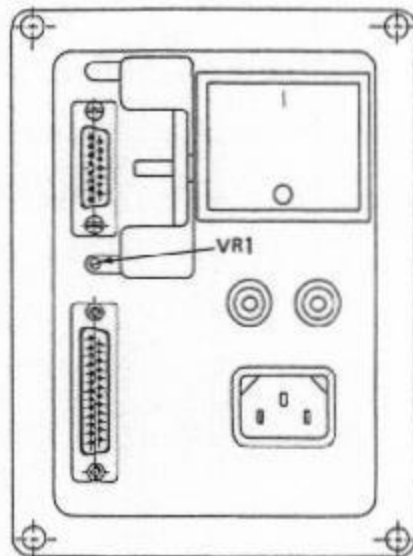
The incubator air temperature will be set and controlled at 34°C thereafter.

Note) Should initial setting be interrupted, conditions before setting will be retained. Should initial setting be completed and stopped simultaneously, it cannot be said for sure that such initially set values have been accepted by the control unit. Therefore, repeat initial setting.

11. Over-temperature Adjustment

Adjust VR1 on the over-temperature detection circuit (6-2) in the same way as in 8-2 Test Mode 2 (over-temperature test).

VR1 is accessed at the sensor connector lock key section on the power switch mounting panel on the side of the power unit.

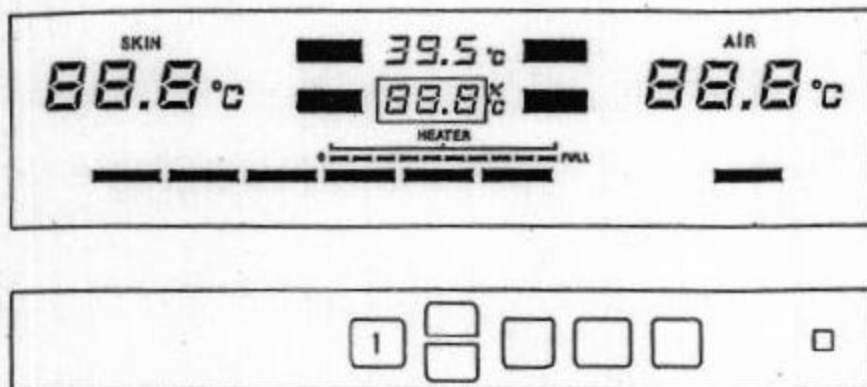


* Preparation of operation 1

... Turn VR1 fully clockwise (so that an over-temperature alarm may not be given when the incubator air temperature rises to 39.5°C).

* Preparation of operation 2

... As in 8-2 Test Mode 2, turn the power switch on while depressing Panel Switch 1 (setting), and hold Switch 1 until the self-diagnosis program is completed. Test Mode 2 (over-temperature test) is selected when the incubator air temperature setting reads 39.5°C.



* VR1 adjustment

... When the incubator air temperature stabilizes at 39.5°C, turn VR1 slowly counterclockwise until an over-temperature alarm is given.

* Verification

... Turn the power switch off, lower the incubator air temperature and cancel the alarm. Select Test Mode 2 again and raise the incubator air temperature toward 39.5°C to verify that an over-temperature alarm is given with the incubator air temperature at 39.5 ±0.5°C.

LIST OF ALARMS ON V-850 INFANT INCUBATOR

Alarm Function	Alarm Condition	Delay Time	Heater output	Flashing/Intermittent Sound	Flashing/Continuous Sound	Illuminated/Continuous Sound	Automatic Reset	Manual Reset	15 min. Silence
Internal Air Circulation	Motor has stopped, fan isn't attached, air inlet or air outlet blocked, or any other trouble has developed within the air circulation system (except during warming-up).	Within 15 min.	Off	○	-	-	-	When the unit has returned to normal conditions.	-
Over-Temperature	Incubator air temperature is $39.5 \pm 0.5^{\circ}\text{C}$	Immediately	Off	○ (Incubator air temperature indicator display figure flashes.)	-	-	Within the range of $34.0 - 37.0^{\circ}\text{C}$.		-
Power Failure	Power failure, disconnected power plug, broken power cable, actuation of circuit breaker, etc.	Immediately	-	-	-	○	-	-	-

Alarm Function	Alarm Condition	Delay Time	Heater output	Flashing/Intermittent Sound	Flashing/Continuous Sound	Illuminated/Continuous Sound	Automatic Reset	Manual Reset	15 min. Silence
Pre-selected Temperature (The alarm function will be enabled once the normal range is reached. An alarm will be given if more than 50 min. is over before the normal range is reached.)	Skin temperature is above pre-selected temperature by more than 1°C.	Within approx. 12 seconds	off	-	(Skin temperature indicator display figure flashes.)	-	○	-	○
	Skin temperature is below pre-selected temperature by more than 1°C.	Within approx. 12 seconds	Unchanged	(Skin temperature indicator display figure flashes.)	-	-	○	-	○
	Incubator air temperature is above pre-selected temperature by more than 1.5°C.	Within approx. 12 seconds	off	-	(Incubator air temperature indicator display figure flashes.)	-	○	-	○
>37°C	Incubator air temperature is below pre-selected temperature by more than 3°C.	Within approx. 12 seconds	Unchanged	(Incubator air temperature indicator display figure flashes.)	-	-	○	-	○
	Incubator air temperature is over 37.0°C.	Immediately	Unchanged	-	-	An audible alarm will sound for 2 seconds when the indicator lamp is illuminated.	○	-	-

Alarm Function	Alarm Condition	Delay Time	Heater Output	Flashing/Intermittent Sound	Flashing/Continuous Sound	Illuminated/Continuous Sound	Automatic Reset	Manual Reset	15 min. Silence
Temperature Sensor	Incubator air temp sensor Over temp sensor Air flow sensor RH sensor Wall temp sensor	Immediately	off	-	Defective sensor display figure and indicator flash.	-	-	When the unit has returned to normal conditions.	-
	Incubator air temp sensor Over-temp sensor Air flow sensor RH sensor Wall temp sensor	Immediately	off	Defective sensor display figure and indicator flash.	-	-	-	When the unit has returned to normal conditions.	-
Skin temperature probe	Shorted	Immediately	off	-	Skin temperature display figure and indicator flash.	-	-	When the unit has returned to normal conditions.	-
	Disconnected or connector is not properly connected.	Immediately	off	Skin temperature display figure and indicator flash.	-	-	-	When the unit has returned to normal conditions.	-

Alarm Function	Alarm Condition	Delay Time	Heater Output	Flashing/Intermittent Sound	Flashing/Continuous Sound	Illuminated/Continuous Sound	Automatic Reset	Manual Reset	15 min. Silence
Heater Disconnected	Heater is disconnected, relay is defective, connector is not properly connected, etc.	Immediately	off	Heater indicator flashes.	-	-	-	When the unit has returned to normal conditions.	-

13. Troubleshooting

13-1 When power switch to turned on

*1 No operation →

LCD unit signal line off.

(CPU,,heater, etc. are controlled properly, but no display)

Power isn't supplied, but no power failure detection.

- a. Connector in power unit is off.
- b. Check power failure detection circuit.

*2 Power failure alarm occurs →

AC power isn't supplied.

DC power isn't supplied.

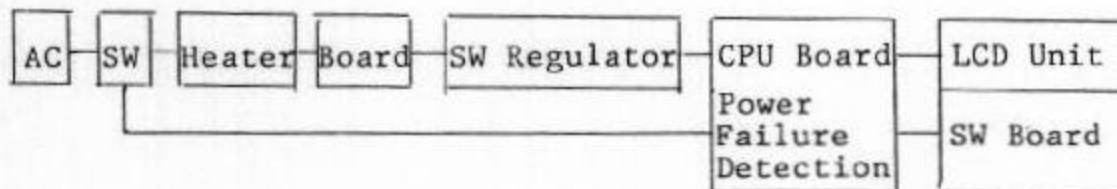
- a. Power cord off.
- b. Connector in power unit is off.

*3 Power failure alarm occurs
LCD display abnormal
Backlight illumination

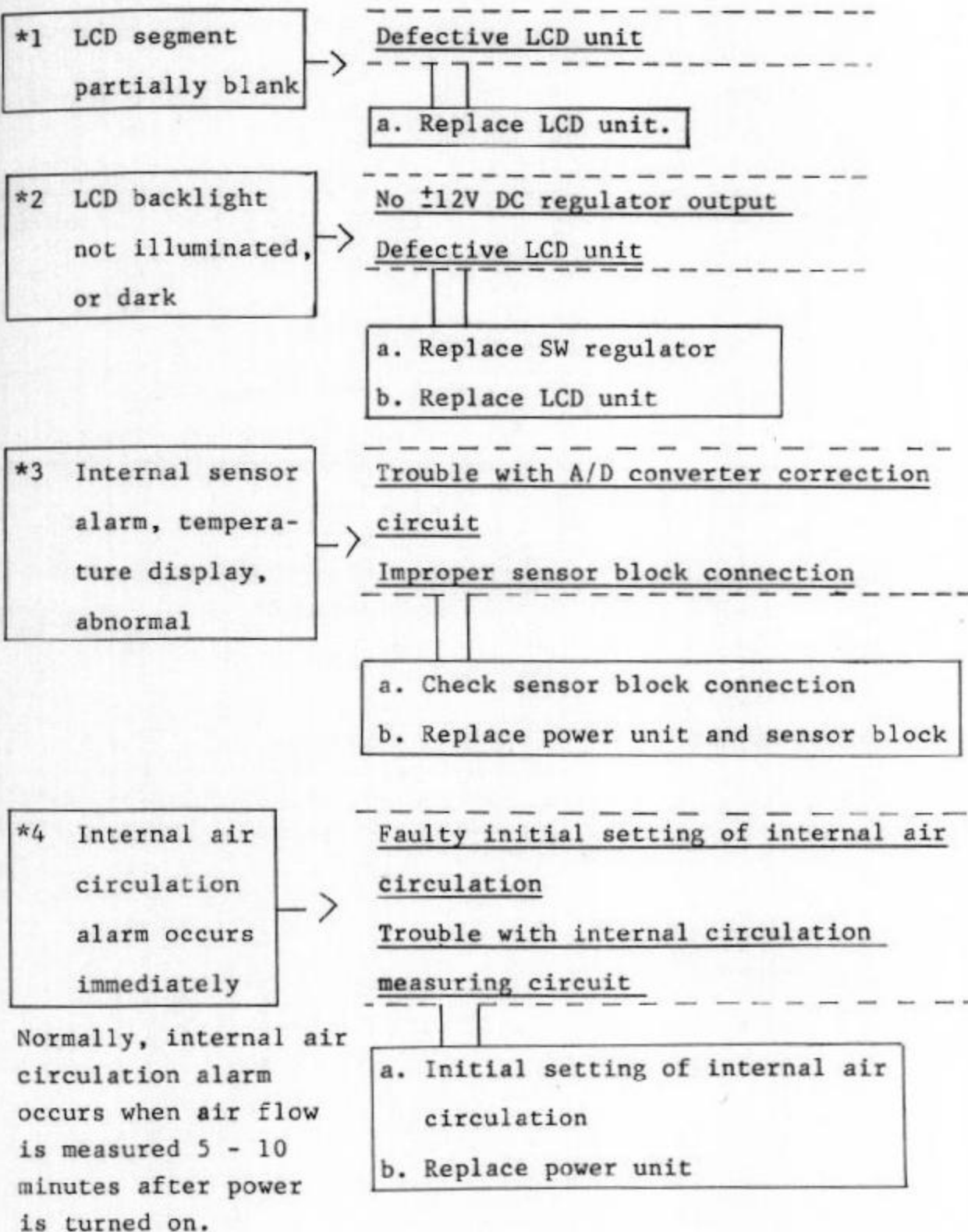
CPU runaway

* Turn off power then on .. OK?

- a. Check power unit totally.



13-2 Immediately after self-diagnosis test



13-3 Over-temperature alarm

*1 Over-temperature alarm occurs though incubator air temperature display hasn't reached 39.0°C.

Temperature of over-temp sensor within inlet isn't high.

Faulty over-temp adjustment
Faulty over-temp detection circuit

- a. Over-temperature adjustment (11)
- b. Repair or replace CPU board (6-2)

Temperature of over-temp sensor within inlet is high

Some trouble with air circulation system in incubator

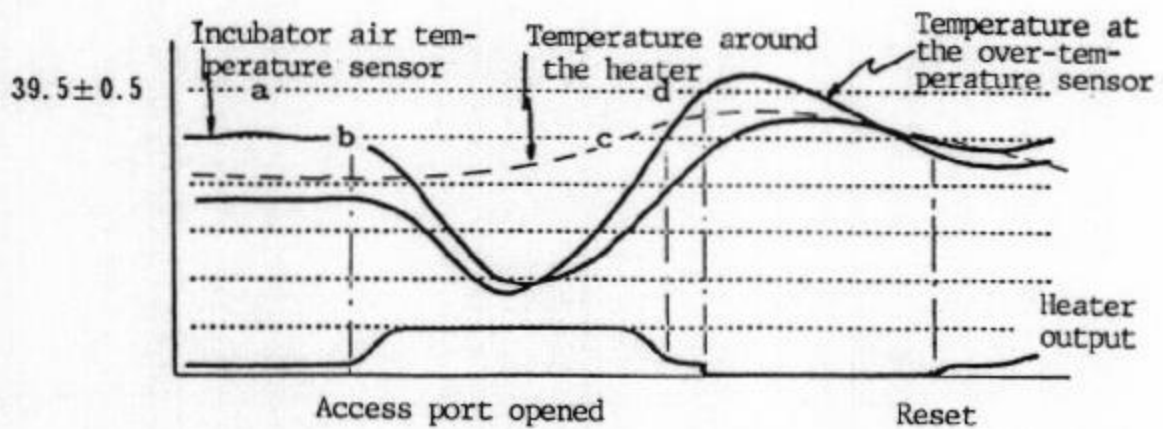
* Internal air circulation alarm may occur.

- a. Check internal air circulation (8-1)
- b. Check setting of unit.

Note) The following is an example in which an over-temperature alarm occurs:

Following stabilized control (a), an access port was opened for treatment or other reasons (b). The temperature at the incubator air temperature sensor dropped, and the heater output was increased to compensate for the loss. Thus only the temperature around the heater was

raised (c). When the access port was closed, excessive heat raised the incubator air temperature temporarily, the Temperature at the over-temperature sensor near the heater was raised into the over-temperature detection range, and thus an alarm was given (d).



13-4 Internal air circulation alarm

*1 Internal air alarm occurs immediately after power is turned on. → See 14-2

*2 Alarm occurs →

Trouble with internal air circulation.

a. Anything to disturb internal air circulation?

(Check Point)

- * Is fan motor active? Attached?
- * Isn't air inlet or outlet blocked?
- * Are incubator deck, hood, etc. properly installed?
- * Is humidity reservoir properly installed?

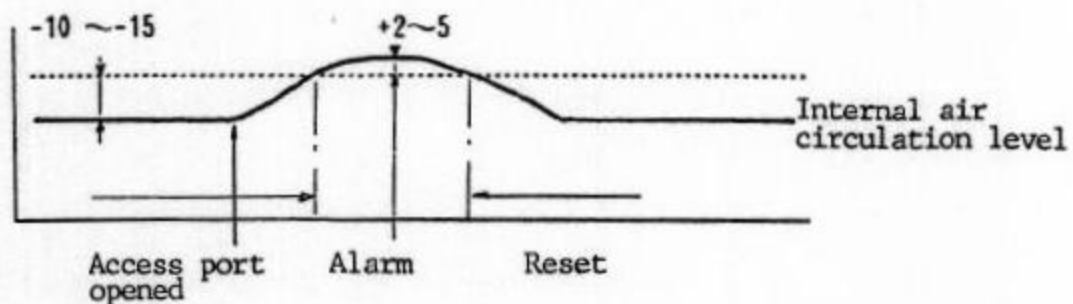
*3 Alarm occurs →

Trouble with internal air circulation.

a. Isn't internal air circulation disturbed?

(Check Point)

- * Sudden air flow disturbance and temperature change due to opened access ports might cause an alarm (8-1).



*4 Alarm occurs



Faulty initial setting of internal
air circulation

Trouble with internal circulation
measuring circuit

- a. Initial setting of internal
air circulation (10)
- b. Replace power unit

13-5 Internal sensor alarm

*1 Internal sensor alarm occurs, and temp displays are all blank.

Status of sensor unit isn't
inputted to CPU

- a. Sensor unit connector disconnected.
- b. Defective sensor unit.
Replace.

*2 Internal sensor alarm occurs, and temp displays read L0 or H1.

In case of L0, either sensor
input temp is low or sensor dis-
connected.

In case of H1, either sensor input
temp is high or sensor shorted.

-
- a. Repair or replace sensor unit.
 - b. Repair or replace CPU board,
and A/D converter input circuit.

*3 Internal sensor alarm occurs, and temp displays are abnormal.

A/D converter input value is
normal. Trouble with temp
correction.

-
- a. Repair or replace CPU board,
and A/D converter input
correction circuit

13-6 Others

*1 Heater output
display flashes.
Alarm occurs.

Specified heater output isn't
supplied.

- a. Heater output connector disconnected.
- b. Defective heater board or defective CPU board.
- c. Heater disconnected.

*2 Temp and other
sensors malfunction

External factor

- a. Is sensor free from spills, dust, scar, etc. ?
- b. Check power unit totally.

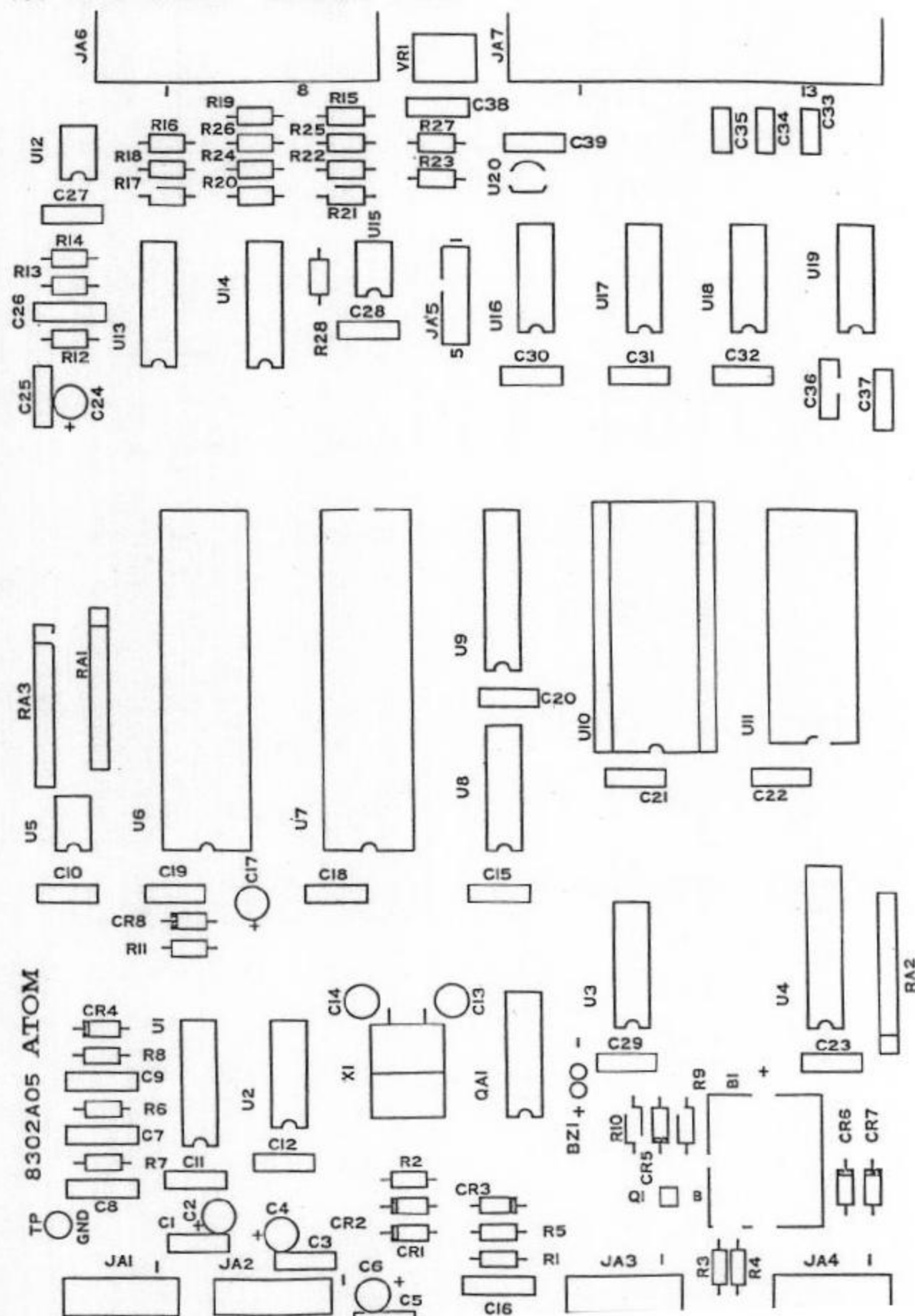
14. Reporting of Trouble

Should any trouble develop on V-850 Infant Incubator and repair be requested or inquiry made, please report to your repair department following the example of a report form given below to help inquire into possible causes of trouble.

* Trouble Report

Name of Hospital		Date	
Description & No. of Unit		No. of Power Unit	
Details of Trouble			
Factors Related to Trouble Reported			
1. Servo/Manual		2. Pre-selected Temperature	
3. Patient's Skin Temperature		4. Incubator Air Temperature	
5. Wall Temperature		6 RH	
7. Alarm			
8. Values Obtained in Test Mode 1.			
0ch		OP	
1ch		FA	
2ch		SE	
3ch		So	
4ch		H7	
5ch		V1	
6ch		V2	
7ch		Pd	
		Reported by	

15. P.C. Boards 8302A board



16. Board Components List

C230710 CKT BOARD ASSY:8302A

1/3

Part No.	Name & Description	Component No
C237916	CKT BOARD:8302A	PCB-1
N011011	FIXED CARBON FILM RESISTOR	R-4
N015111	"	R-9
N017511	"	R-10
N011621	"	R-5
N015121	"	R-2, R-3
N012031	"	R-1, R-11
N011341	"	R-28
N012041	"	R-7
N013341	"	R-6
N011251	"	R-8
N031000	FIXED METALIZED FILM RESISTOR	R-23
N034420	"	R-27
N0311310	"	R-25
N032001	"	R-22
N032491	"	R-12
N033011	"	R-21
N033571	"	R-26
N032492	"	R-13, R-14
N040040	FIXED METALIZED FILM RESISTOR	R-15
N040050	"	R-16
N040060	"	R-17
N040070	"	R-18, R-19,
		R-20, R-24
N060805	RESISTOR NETWORK	RA-1, RA-2,
		RA-3
N110012	SOLID TANTALUM CAPACITOR	C-2, C-24
N110025	"	C-17
N110035	"	C-4, C-6
N120002	CERAMIC CAPACITOR	C-13, C-14
N120003	"	C-33, C-34,
		C-35
N120015	"	C-3, C-5,
		C-36, C-37,
N120011	"	C-1, C-10,
		C-11, C-12,
		C-15, C-18,
		C-19, C-20,
		C-21, C-22,
		C-23, C-25,
		C-27, C-28,
		C-29, C-30,
		C-31, C-32,
		C-38, C-39
N132045	METALIZED POLYESTER CAPACITOR	C-7, C-8,
		C-16
N132047	"	C-9, C-26

Part No.	Name & Description	Component NO
N350004	SILICON DIODE	CR-1, CR-2, CR-3, CR-4, CR-5, CR-6, CR-7, CR-8
N400003	PNP TRANSISTER	Q-1
N420001	TRANSISTER NETWORK	QA-1
N480010	OPERATIONAL AMPLIFIER IC	U-15
N503008	LOW-VOLTAGE REFERENCE IC	U-12
N510003	A/D CONVERTER IC	U-13
N530430	CMOS IC	U-14
N530640	"	U-2
N531120	"	U-3
N531210	"	U-1
N540040	CMOS HIGH SPEED CMOS IC	U-16
N540160	"	U-17
N540400	"	U-8
N541020	"	U-4, U-9
N562001	16x16 BIT SERIAL NOVRAM	U-5
N470008		U-20
N470009		U-19
N470010		U-18
N580010	MICROPROCESSOR	U-7
N581010	MULTI I/O	U-6
N581030	MULTI I/O	U-11
P171002	IC SOCKET	(U-5)
P171003	"	(U-10)
N070006	TRIMMER POTENTIOMETER	VR-1
N210001	CRYSTAL OSCILLATER	XL-1
P150301	PS CONECTER	JA-1, JA-2, JA-3, JA-4
P150108	PS CONECTER	JA-5
P150372	"	JA-6
P150373	"	JA-7
R015004	Ni-Cd BATTERY	B-1
N261009	BUZZER	BZ-1
P220009	SPACER	
V011273	SCREW	
V114302	SCREW	

C230710 CKT BOARD ASSY:8302A

3/3

Part No	Name & Description	Component NO
N570002	EPROM	U-10
C237806	INC-V13B2 ('87.9 PROGRAM)	
C237814	INC-V17B6 ('89.5 PROGRAM)	

C230710 CKT BOARD ASSY:8302A

3/3

Part No	Name & Description	Component NO
N570002	EPROM	U-10
C237806	INC-V13B2 ('87.9 PROGRAM)	
C237814	INC-V17B6 ('89.5PROGRAM)	